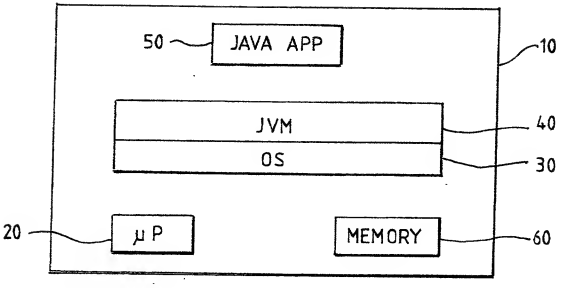
50
JAVA APP
10
JVM
40
OS
30
20
μP
MEMORY
60

FIG. 1

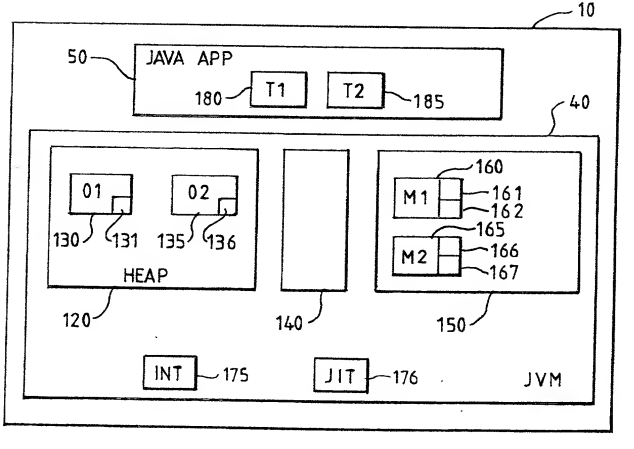
10
50
JAVA APP
180
T1
T2
185
40
01
02
130
131
135
136
HEAP
120
140
160
M1
161
162
165
M2
166
167
150
INT
175
JIT
176
JVM

FIG. 2

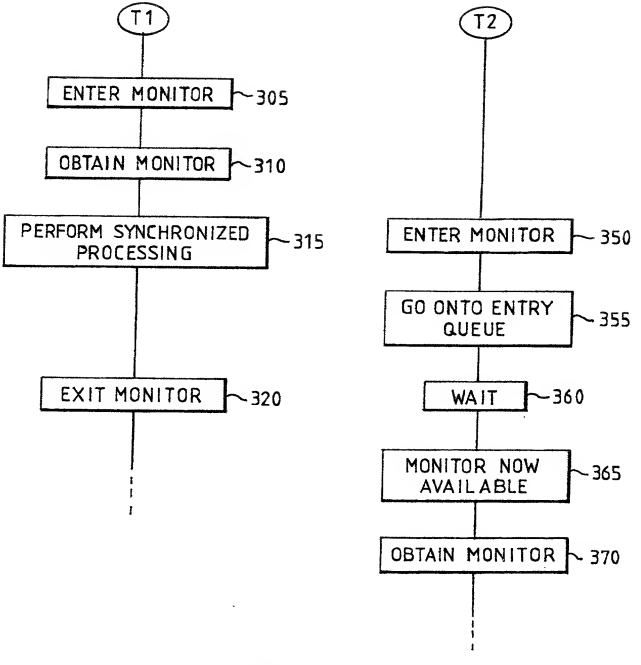
T1
ENTER MONITOR
305
OBTAIN MONITOR
310
PERFORM SYNCHRONIZED PROCESSING
315
EXIT MONITOR
320
T2
ENTER MONITOR
350
GO ONTO ENTRY QUEUE
355
WAIT
360
MONITOR NOW AVAILABLE
365
OBTAIN MONITOR
370

FIG. 3

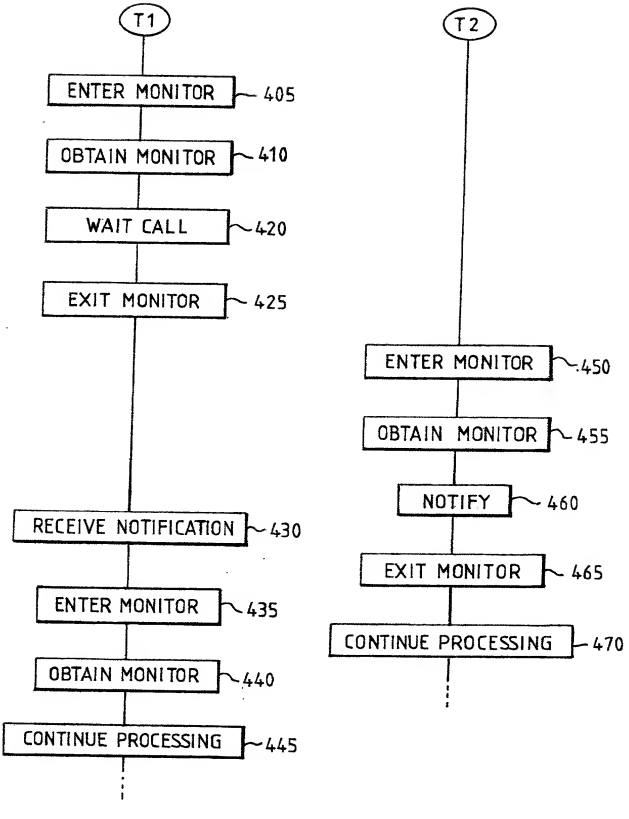
T1
ENTER MONITOR
405
OBTAIN MONITOR
410
WAIT CALL
420
EXIT MONITOR
425
RECEIVE NOTIFICATION
430
ENTER MONITOR
435
OBTAIN MONITOR
440
CONTINUE PROCESSING
445
T2
ENTER MONITOR
450
OBTAIN MONITOR
455
NOTIFY
460
EXIT MONITOR
465
CONTINUE PROCESSING
470

FIG. 4

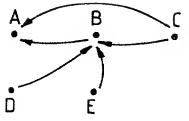

FIG. 5A

$$R = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \overset{\text{TO}}{\begin{array}{ccccc} A & B & C & D & E \end{array} } \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{pmatrix} \end{array}$$

FROM

$$R^2 = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{pmatrix} \end{array}$$

$$R^3 = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \end{array}$$

FIG 5B

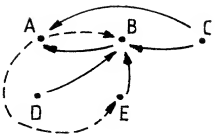

FIG. 6A

TO

	A	B	C	D	E
A	0	1	0	0	1
B	1	0	0	0	0
C	1	1	0	0	0
D	0	1	0	0	0
E	0	1	0	0	0

$= R$

FROM

	A	B	C	D	E
A	1	1	0	0	0
B	0	1	0	0	1
C	1	1	0	0	1
D	1	0	0	0	0
E	1	0	0	0	0

$= R^2$

	A	B	C	D	E
A	1	1	0	0	1
B	1	1	0	0	0
C	1	2	0	0	1
D	0	1	0	0	1
E	0	1	0	0	1

$= R^3$

FIG. 6B

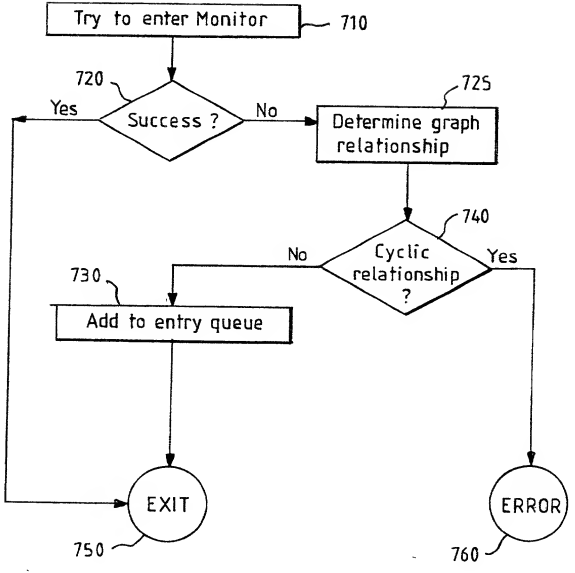
Try to enter Monitor
710
720
Success ?
Yes
No
725
Determine graph relationship
740
Cyclic relationship ?
No
Yes
730
Add to entry queue
EXIT
750
ERROR
760

FIG. 7

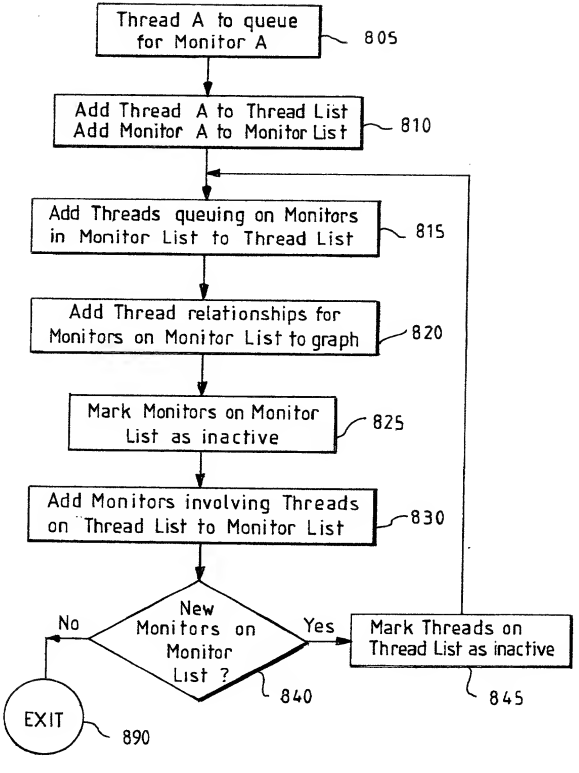
Thread A to queue for Monitor A
805
Add Thread A to Thread List
Add Monitor A to Monitor List
810
Add Threads queuing on Monitors in Monitor List to Thread List
815
Add Thread relationships for Monitors on Monitor List to graph
820
Mark Monitors on Monitor List as inactive
825
Add Monitors involving Threads on Thread List to Monitor List
830
New Monitors on Monitor List ?
840
No
Yes
Mark Threads on Thread List as inactive
845
EXIT
890

FIG. 8